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**Formal Comments on the Public Draft of Bulletin 160-2005,
The California Water Plan
July 18, 2005
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Summary Comments

We applaud the efforts of the California Department of Water Resources and its staff in producing the Public Review Draft of the California Water Plan, Bulletin 160-2005. We consider it to be a significant improvement over previous Plans in many respects. Please consider the comments below to be constructive criticism, based on the four years of effort put into the Public Advisory Committee by one of the authors of these comments.

- The three scenarios developed by DWR do not sufficiently reflect a diverse range of plausible water futures. Rather they are slight variants on traditional projections showing rising water demand. A “high efficiency” scenario should be included for comparison. The Pacific Institute has prepared such a scenario using the same model used by DWR. The draft of this analysis has already been sent to DWR; the final will be available in August.
- The “Current Trends” scenario does not adequately address actual current trends in water prices, crop shifts, or adoption of efficiency technologies. The “Current Trends” scenario should have truly reflected current trends.
- The “Less Resource Intensive” scenario excludes a wide range of efficiency options that we know to be both cost-effective and achievable with existing technologies. This should be made explicit (see below for a proposed addition to the text).

¹ These comments were prepared by Dr. Peter H. Gleick and Heather Cooley, both of the Pacific Institute.

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- Water use in all scenarios is highly dependent on total population, yet the newest 2030 population estimates from the U.S. Census Bureau are 3.5 percent below the estimates available at the time from the California Department of Finance. We do not recommend redoing the scenarios, but a prominent note about this should be included.
- The Water Plan projects that agricultural and urban water prices will increase by 10% and 20%, respectively, between 2000 and 2030. The historical trend of water prices suggests that the price projections used in the Water Plan are too low. More realistic price projections should be used in the scenarios.
- The groundwater overdraft estimate of 2 maf is added onto all future demand projections. This estimate is unsupported by analysis, even by DWR. Moreover, eliminating overdraft may be done in ways completely separate from the calculations done for the scenarios. Simply tacking an unsubstantiated number onto all three scenarios is inappropriate. We urge that this approach (and the figure on page 5 of the Framework for Action “Changes Plus Groundwater Overdraft”) be eliminated.
- Serious flaws exist in the figure entitled “Range of Additional Supply for Eight Resource Management Choices” that appears on the bottom of Page 15 of the California Water Plan Highlights. This figure is misleading and must be corrected. Specific suggestions are listed below.
- The scenarios have limitations. These limitations must be included wherever the scenarios are discussed. Not everyone will read the Water Plan in its entirety and presenting results without this caveat is misleading. See suggestions below.
- Climate change has serious implication for water management in California. The seriousness of the problem warrants greater inclusion in the Water Plan, particularly in the Water Plan Highlights and throughout the relevant Resource Management Strategies (“Floodplain Management,” “Watershed Management,” “Desalination,” and “Urban Runoff Management”).



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Comments on the 2030 Water Scenarios

After extensive discussion and debate within the Bulletin 160 Public Advisory Committee, the 2005 California Water Plan adopted a long-term effort to develop multiple scenarios of water supply and demand rather than the single scenario typical of most Bulletin 160s. To initiate this effort, the 2005 Water Plan staff and Public Advisory Committee developed three scenarios of future water demand in California, named “Current Trends,” “Less Resource Intensive,” and “More Resource Intensive.” The three scenarios developed for the 2005 version provide estimates of the quantity of water that would be used in 2030 under specified demographic, economic, agricultural, and water management factors. The differences among the scenarios are the result of different assumptions about these various factors.

Despite the fact that the new California Water Plan offers multiple scenarios for the first time in decades, a closer analysis reveals that these scenarios are not significant, or even dramatic, departures from past analyses. All three DWR scenarios include modest efficiency improvements, but nowhere near the levels already demonstrated to be cost-effective and technically achievable today.

All Three Scenarios are “No Action” Scenarios and Underestimate Likely Conservation and Efficiency Efforts

The scenarios are all referred to as “no action,” because their outcomes can be achieved “without additional management intervention beyond those currently planned” (DWR 2005; pp. 4-9, Volume 1, Chapter 4 “Preparing for an Uncertain Future”). While we applaud the effort to use scenarios, the specifics of these three raise a number of concerns. By including only “no action” scenarios, the Water Plan fails to examine the full range of possible futures for California and misses an opportunity to explore an efficient water path by which to guide actions and decisions. As a result, the three scenarios provide a misleading and incomplete picture of California’s water future.



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For the urban sector, the DWR Water Plan scenario assumptions focus on water conservation that occurs without additional policy intervention (called “naturally occurring conservation” or NOC). The conservation estimates are based on a study produced by A&N Technical Services (2004) on behalf of the California Urban Water Agency (CUWA). Using the data and assumptions contained in the A&N Technical Services report along with year 2000 DWR domestic water-use estimates, the Water Plan projects that 2030 NOC and efficiency due to the implementation of a subset of BMPs would decrease per-capita water demand by about 10% and 5% of 2000 demand, respectively, in the Current Trends scenario. The same NOC and Efficiency estimates are used for the commercial, industrial, and institutional sectors. Efficiency estimates for the More Resource Intensive and Less Resource Intensive scenarios are the same as in the Current Trends scenario (5%). Estimates for NOC in the More Resource Intensive and Less Resource Intensive scenarios are 5% and 15%, respectively; these values are arbitrarily chosen and are simply $\pm 5\%$ of the values used in the Current Trends scenario. Because overall population rises much faster than this improvement in efficiency, total urban water use in all three of the DWR scenarios actually rises.

The level of conservation modeled in the Water Plan is expected to occur without any new policies, such as through existing plumbing codes and continued implementation of current Best Management Practices (BMPs) in the Memorandum of Understanding (MOU) (CUWCC 2004). This assumption excludes a wide range of efficiency options that we know to be both cost-effective and achievable with existing technologies (Mayer et al. 1999, Gleick et al. 2003).² The BMPs represent limited efforts by water utilities and are not comprehensive in either scope or magnitude. We believe the DWR assumption also overestimates the “decay” of conservation savings, as noted in Gleick et al. (2003).

² Mayer, P.W., W.B. DeOreo, E.M. Opitz, J.C. Kiefer, W.Y. Davis, B. Dziegielewski, and J.O. Nelson. 1999. Residential End Uses of Water. Final Report. American Water Works Research Foundation, Denver, Colorado; Gleick, P. H., D. Haasz, C. Henges-Jeck, V. Srinivasan, G. Wolff, K.K. Cushing, and A. Mann. 2003. Waste Not, Want Not: The Potential for Urban Water Conservation in California. Pacific Institute for Studies in Development, Environment, and Security. Oakland, California.



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The Agricultural Efficiency Assumptions are Especially Weak

The potential for improving agricultural water-use efficiency is less well understood, because inadequate research and analysis has been done. As a result, many of the variables specified in the scenario model are placeholders. We strongly urge DWR to continue work on this subject and to include a more thorough analysis of agricultural efficiency in future Water Plans.

As a suggestion, non price-driven efficiency can be estimated using a “bottom-up” approach based on historical changes in irrigation method by crop type and the relative efficiency of each method. Surveys of irrigation methods by crop type in California have been conducted periodically between 1972 and 2001. These surveys show that for all crops combined the use of gravity/flood irrigation and sprinklers has declined, while micro/drip and subirrigation use has increased. Field studies have been conducted comparing the water use and yield of various crops under different irrigation methods, showing that micro/drip irrigation is more efficient than sprinkler or flood irrigation. The historical changes in irrigation method by crop type and the relative efficiency of each method can be combined to project changes in water use over time.

Scenario Assumptions About Water Price Trends Do Not Reflect Historical Experience or Expected Changes.

Modest price- and non price-driven efficiency improvements are included in the three scenarios, although these improvements are nowhere near what has been shown to be cost-effective. Agricultural and urban water prices are a vital component of demand projections, as they are important efficiency drivers. The Water Plan projects that agricultural and urban water prices will increase by 10% and 20%, respectively, between 2000 and 2030. No documentation is provided for these estimates.

The historical trend of urban water prices suggests that the price projections used in the Water Plan are too low. According to the annual urban water-price surveys in



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California conducted by Black and Veatch between 1991 and 2001, actual increases have been about 1.1 percent annually.³ If this continues to compound at the same rate, urban prices will go up an average of 41% between 2000 and 2030.

An analysis of the historical trend of agricultural water prices also suggests that the Water Plan's projection is too low. To project changes in agricultural water price between 2000 and 2030, we assume that recent increases in the cost of service (CoS) rates, which include operation and maintenance, capital, and deficit costs, for Central Valley Project (CVP) contractors will apply to all supplies, regardless of source. Agricultural users served by the CVP will likely experience additional price increases because they are currently behind on repaying the project costs. Combining the estimated price increases for CVP contractors with rising CoS rates for the remainder of agricultural water users, we project that overall agricultural water price will increase by 68% statewide between 2000 and 2030.

The Water Plan's assumptions about price result in an underestimate of price-driven efficiency. The relationship between water demand and price is specified by an elasticity factor. Elasticity is a measure of the responsiveness of one economic variable (water demand) to changes in another economic variable (water price). Because the quantitative relationship between price and demand is negative, meaning that as price increases, demand goes down, the Water Plan's assumptions about water price result in an overestimate of future demand.

An Additional Scenario Reflecting Conservation Potential Should Have Been Prepared.

The Water Plan stresses the importance of conservation and efficiency: “[w]ater use efficiency will continue to be a primary way that we meet increased demand” (DWR 2005; Volume 1, pp. 2-3). In Volume 2, Chapter 1 (“Introduction-Resource Management Strategies”), Figure 1-1 suggests that urban water use efficiency can provide a supply

³ Black and Veatch. 2001. California Water Charge Survey. Irvine, California.

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benefit of between 1.1 and 2.3 maf/y by reducing demand. Agricultural water use efficiency estimates are more modest, ranging from 0.2 – 1 maf/y. A more thorough analysis might have included these efficiency estimates in at least one of the scenarios projecting 2030 demand.

All the Scenarios Are Strongly Dependent on Population Forecasts, But These Are Changing

A key assumption in the scenario model is that water use is directly dependent on population. While this is largely true, estimates of future populations are highly uncertain. Indeed, the latest U.S. Census Bureau estimate for California’s population in 2030 has dropped nearly 6 percent from the Bureau’s previous projection for 2025 (five years earlier), and is more than 3.5 percent below the California Department of Finance projection for 2030.⁴ This has direct implications for the base water use in all three scenarios. We do not recommend that DWR redo the scenarios; we *do* recommend that two explicit notes be included: one calling attention to the sensitivity of total water use to the assumptions about population, and a second note about trends in population forecasts.

The Limitations Of The Scenarios Must Be Clearly Stated

Volume 1, Chapter 4 entitled “Preparing for an Uncertain Future” briefly describes the scenarios used to project 2030 demand, and DWR’s plans to further develop analytic tools to evaluate several quantitative scenarios of demand and supply and to evaluate how different response packages might perform across them in time. In Volume 1, pp. 4-15, DWR makes the following statement:

⁴ The previous U.S. Census projections were released in late 1996. The California population projection was 49.3 million in 2025 according to Series A (the preferred series based on a time-series model). State projections are consistent with the 1990 census
<<http://www.census.gov/population/www/projections/stproj.html>> (released October 1996).



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“While instructive, these preliminary estimates cannot be used as indicators of potential future shortages because they describe what additional water demands California could face in 2030 without additional demand management beyond current policies.”

This statement is an important reminder about the limitations of the scenarios and must be included wherever the scenarios are discussed. Everyone will not read the Water Plan in its entirety and presenting results without this caveat is misleading. Specifically, we would recommend its inclusion on pages 4-5 of the “California Water Plan Highlights.”

Groundwater Overdraft Estimate Is Unsupported By Analysis

The Water Plan assumes that current groundwater overdraft is 2 maf/yr. This estimate is added onto all three projections of 2030 demand. The overdraft estimate, however, is unsupported by analysis, even by DWR. According to the most recent state report on California’s groundwater, Bulletin 118-03, “a comprehensive evaluation of groundwater overdraft has not been conducted since Bulletin 118-80, but it is estimated that overdraft is between 1 million and 2 million acre-feet annually.” Bulletin 160-98 provides further discussion on the matter, estimating that groundwater overdraft in 1995 was 1.5 maf, largely due to overdraft in the Central Coast, Tulare Lake, and San Joaquin River hydrologic regions. More importantly, overdraft is expected to decline to 1.1 maf by 2020 due to construction of the Coastal Branch of the California Aqueduct (which will reduce groundwater use near the central coast) and a reduction in irrigated acreage on the west side of the San Joaquin Valley.

In addition, eliminating any remaining overdraft may be done in ways completely separate from the calculations done for the scenarios. Chapter 4 of Volume 2 on Conjunctive Use states that 2 million acre-feet of additional supply could be developed with 20 million acre-feet of conjunctive use systems. Thus while groundwater overdraft is a problem throughout parts of California with real consequences, including land

subsidence, reduced flow in surface streams, and saltwater intrusion in coastal aquifers, simply tacking an unsubstantiated number onto all three scenarios is inappropriate. The figure on page 5 of the Framework for Action Highlights (“Changes Plus Groundwater Overdraft”) should be deleted, or it should be shown without any overdraft estimates included. A footnote stating that no groundwater overdraft is included might be appropriate.

The Options/Quantities Figure in the “Framework for Action Highlights” Is Inaccurate and Misleading

Serious flaws exist in the figure entitled “Range of Additional Supply for Eight Resource Management Choices” that appears on the bottom of page 15 of the Framework for Action Highlights. The figure mixes different kinds of options, the quality of which varies from good to terrible. The ranges shown are incorrect and inadequately represented.

For example, the agricultural water use efficiency estimate is grossly incomplete. As Volume 2 notes, these estimates **do not include substantial water efficiency approaches**: “Benefits resulting from implementation of other advanced technologies in hardware, water management, and crop evapotranspiration, crop shifts and reducing crop transpiration have not been quantified for this narrative.” [Volume 2, pp. 3-5]. Yet these unquantified savings could be many times larger than the upper limit shown in the Figure.

As another example, the upper limit of the urban water use efficiency number is derived from the Pacific Institute’s study, but this is **neither an upper limit on conservation potential; nor does it apply to 2030 forecasts** – it is an estimate of currently (year 2000) achievable conservation potential given typical water technology available in 2000. Because conservation lowers per capita consumption, population growth leads to even greater savings over current use. It also represent a “reduction in



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demand” not an increase in supply. Sometimes these are the same; sometimes they are not.

A proper caption would note that the numbers are highly uncertain, especially the figures for agricultural water use efficiency. It would note that the cost of these different options is not indicated. It would also eliminate the phrase “additional supply” (in the caption and on the Y-axis) and note these management choices produce either new supply or reduce demand.

Inadequate Attention To The Issue Of Climate Change

Climate change has serious implication for water management in California. We are pleased that the current draft addresses this issue more completely than any previous Bulletin 160. Volume 1, Chapter 4 (“Preparing for an Uncertain Future”) discusses some of these implications, including changes in the snowpack, hydrologic patterns, and aquatic life. But, the seriousness of the problem warrants greater inclusion in the Water Plan, particularly in the Water Plan Highlights and throughout the relevant Resource Management Strategies (“Floodplain Management,” “Watershed Management,” “Desalination,” and “Urban Runoff Management”).

For example, the “Roadmap to 2030” is presented on pages 6-9 of the Water Plan Highlights. This section lacks **any** discussion of climate change. The potential implications of climate change **must** be included in any conversation about California’s resources and the future. This discussion can be drawn from paragraph four in Volume 1, page 4-26 and placed in the Highlights section as follows:

“As a result of global climate change, California's future hydrologic conditions will likely be different from patterns observed over the past century. These changes will have major implications for water supply, flood management, and ecosystem health. The prospect of significant climate change warrants examination of how California’s water infrastructure



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and natural systems can be managed to accommodate or adapt to these changes, and whether more needs to be done.”

In addition, the sentence below should be modified to more accurately reflect the state of knowledge on the subject. Please replace:

“New surface storage can also help reduce the risk associated with potential future climate change by mitigating the effects of a relatively smaller seasonal snowpack storage capacity.” (Volume 2, pp. 17-3 and pp. 18-2).

With:

“New surface storage may help reduce the risk associated with potential future climate change by mitigating the effects of a relatively smaller seasonal snowpack storage capacity, but these risks may also be reduced more quickly and cheaply by better conjunctive use of surface and groundwater, modifications of operating rules at existing infrastructure, and changes in water demand through conservation and efficiency.”

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